

VA/DOD CLINICAL PRACTICE GUIDELINE FOR THE MANAGEMENT OF ISCHEMIC HEART DISEASE GUIDELINE SUMMARY MODULE A

SUSPECTED ACUTE MYOCARDIAL INFARCTION ST-SEGMENT ELEVATION OR NEW OR OLD LBBB

KEY ELEMENTS

For patients who meet criteria for **emergent reperfusion therapy**:

- Admit to an intensive care unit
- Initiate heparin or low-molecular weight heparin, if indicated
- Warfarin is recommended for patients at risk for systemic embolism (intraventricular clot or atrial fibrillations)
- Initiate IV beta-blocker followed by oral
- Initiate ACE inhibitor therapy in the absence of contraindications.

If less than 12 hours from onset of symptoms:

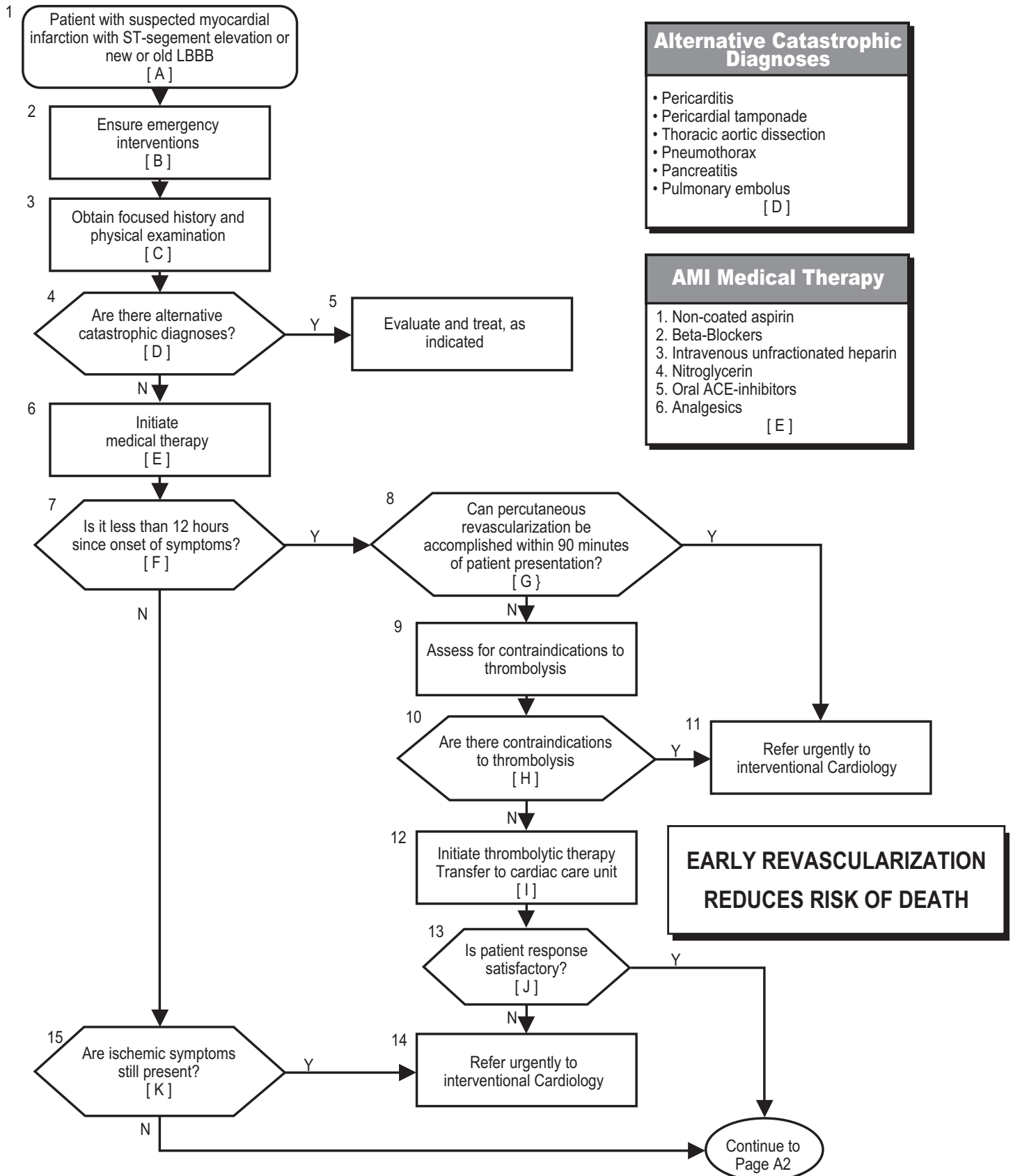
- *Refer to percutaneous coronary intervention (PCI) if intervention can be performed within 90 minutes of presentation in a high volume center by a high volume operator.*
- *Initiate thrombolytic therapy if not contraindicated and not referred for direct PCI.*
- *Refer to PCI if thrombolytic therapy is contraindicated or response to thrombolysis is unsatisfactory.*
- Consider non-invasive evaluation (cardiac stress test)
- Refer to cardiology if at high-risk for death or recurrent MI and/or left ventricular (LV) dysfunction.
- Ensure pharmacological therapy for ischemia, angina, and chronic heart failure (CHF)
- Discharge patient to home with appropriate follow-up.

Patients with acute myocardial infarction (AMI), for which reperfusion therapies may be appropriate, are managed within this module. An AMI for which reperfusion therapies may be appropriate is defined by the following:

- Clinical history of ischemic- or infarction-type symptoms
- Diagnostic electrocardiogram (ECG) findings of new or old left bundle branch block (LBBB) or ongoing ST-segment elevation in two or more contiguous leads (i.e., 0.2 mV or more in leads V₁-V₃, or 0.1 mV or more in other leads)

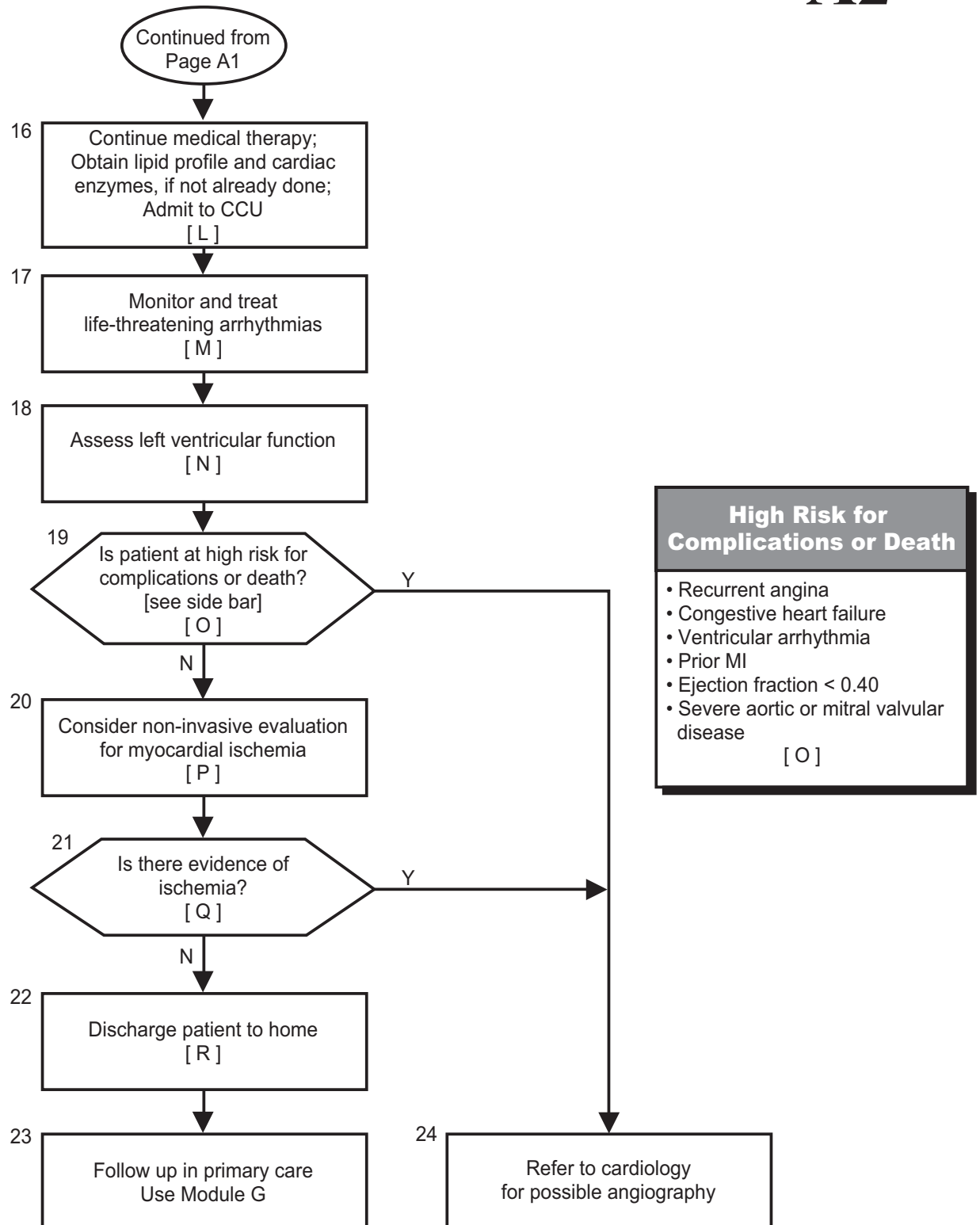
MANAGEMENT OF ISCHEMIC HEART DISEASE
Module A: Suspected Acute Myocardial Infarction
(ST-Elevation or LBBB)

A1



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A2



EMERGENCY INTERVENTIONS

Cardiac monitor: Patients with acute coronary syndromes (ACS), especially with suspected myocardial infarction (MI), should be placed on continuous cardiac monitoring as soon as possible. Potentially lethal ventricular arrhythmias can occur within seconds to hours from the onset of coronary ischemia, and monitoring will allow their immediate detection and treatment.

Oxygen (O₂): Supplemental oxygen should be administered on initial presentation, especially if congestive heart failure (CHF) or oxygen desaturation is present. For uncomplicated MIs, oxygen may be reassessed after six hours. CO₂ retention is not usually a concern with low flow nasal O₂, even in patients with severe chronic obstructive pulmonary disease (COPD).

Aspirin: 160 mg to 325 mg should be chewed immediately to accelerate absorption and should be given even if the patient is on chronic aspirin therapy.

Intravenous (IV) Access: Intravenous access for the delivery of fluids and drugs should be obtained, with both antecubital veins used if possible for multiple infusions, especially if thrombolytic therapy is being considered. Unnecessary arterial and venous punctures should be avoided and experienced personnel should perform access. While the IV is being started, blood samples for cardiac enzymes/markers (i.e., troponin - preferred, CK, CK-MB acceptable), lipid profile, complete blood count (CBC), electrolytes, renal function, international normalized ratio (INR), and activated partial thromboplastin time (APTT) can be obtained, although immediate treatment of ACS should not be delayed by the results from these tests.

Sublingual nitroglycerin should be given, unless the patient is hypotensive or bradycardic, has taken sildenafil within the last 24 hours, or there is a strong suspicion of right ventricular infarction.

ECG: Obtain within 10 minutes of presentation and follow-up with a serial ECG. A right-sided ECG should be performed if a standard ECG suggests an inferior wall MI.

Adequate analgesia

Advanced cardiac life support (ACLS, 1999): algorithm should be applied, as indicated.

Chest X-ray: A portable chest radiograph should be performed, particularly to evaluate for mediastinal widening (aortic dissection), cardiac silhouette, and evidence of CHF.

Transportation: In many settings within the DoD or the VA systems, the patient will need to be urgently transported to a setting where an adequate level of monitoring, evaluation, and treatment is available.

Obtain Focused History and Physical Examination

Patients presenting with an acute ST-elevation myocardial infarction (STEMI) should have an expedited and focused history and physical examination and ECG within 10 minutes of presentation, to assess for eligibility of reperfusion therapy, complications from an AMI, and contraindications to reperfusion therapy.

Specific Clinical History Questions Should Include the Following:

- Characteristics of MI symptoms
- Complications of MI
- Contraindications to Reperfusion Therapy

Focused Physical Examination Should Include:

- Vitals Signs
- Limited examination of skin, lungs, heart, abdomen, peripheral pulse, and focal neurological signs (see full guideline for details)

Alternative Catastrophic Diagnoses

Patients may present with chest pain syndromes that mimic AMI symptoms and signs, including ECG changes typical of an AMI. The focused history and physical examination should help make the appropriate diagnosis. It is important to diagnose such conditions rapidly, as most of them are life-threatening and may be worsened by standard AMI therapies.

Clinical Findings for Alternative Catastrophic Diagnoses	
Diagnoses	Clinical Findings
Pericarditis	<ul style="list-style-type: none"> Pain that is more severe in a supine position Friction rub may be present ECG with diffuse ST-elevation
Pericardial tamponade	<ul style="list-style-type: none"> Jugular venous distension Pulsus paradoxus ECG with low voltage/electrical alternans
Thoracic aortic dissection	<ul style="list-style-type: none"> Very severe midline pain, maximal at onset Pain often radiates to the back Unequal pulses or blood pressure difference in arms
Pneumothorax	<ul style="list-style-type: none"> Associated with trauma, COPD, or mechanical ventilation Unilateral diminished breath sounds Normal or increased resonance to percussion
Pulmonary embolus	<ul style="list-style-type: none"> Pleuritic chest pain Shortness of breath, without evidence of CHF
Pancreatitis	<ul style="list-style-type: none"> History of gall bladder disease or alcoholism Abdominal tenderness Nausea and vomiting

THERAPY

Initial Medical Therapy

Medical therapy should be initiated while preparations are made for reperfusion therapy. Medications that may be given at this time include the following:

Non-Coated Aspirin

- All patients should chew 160 mg to 325 mg of aspirin within 10 minutes of presentation.
- Patients should be given aspirin, even if they are receiving anticoagulation (e.g., warfarin) or antiplatelet agents (e.g., aspirin or clopidogrel) at time of presentation.

- If a patient is unable to take aspirin by mouth because of nausea, vomiting, or other gastrointestinal disorders, 325 mg may be given as a suppository.
- Contraindications to aspirin include a documented allergy to salicylates, active bleeding, or active peptic ulcer disease.
- Patients who have an allergy to aspirin and no contraindication to antiplatelet therapy should be given clopidogrel, ticlopidine, or dipyridamole.

Beta-Blockers

- Metoprolol 5 mg IV up to 3 doses or atenolol 5 mg to 10 mg IV should be given within 12 hours of presentation.
- Oral beta-blockers should be started at the time the intravenous beta-blocker is given.
- Relative contraindications to beta-blockers, include: heart rate <60 beats per minute (bpm), systolic blood pressure <100 mm Hg, moderate or severe CHF, signs of peripheral hypoperfusion, PR interval >0.24 seconds on the ECG, second or third degree atrioventricular (AV) block, severe COPD, and history of asthma.
- Diabetes should not be considered a contraindication to beta-blocker therapy in the setting of an AMI.

Intravenous Unfractionated Heparin

- Unfractionated heparin should be initiated in all patients receiving alteplase, reteplase, or tenecteplase or referred for emergent revascularization. Heparin may be started at 60 U/kg (maximum 4000 U) IV bolus, followed by an infusion of 12 U/kg/hr infusion (maximum 1000 U/hr) with a goal APTT of 50 to 70 seconds. The use of heparin should be continued for 48 hours and then reassessed.
- Patients receiving streptokinase who are at high risk for systemic emboli (i.e., who have a large or anterior wall MI, previous embolus, or known left ventricular (LV) thrombus) should be started on intravenous heparin only if the APTT is <2 times control 6 hours from the initiation of streptokinase. Heparin may then be given with a goal APTT of 1.5 to 2.0 times control.

Nitroglycerin

- Patients presenting with symptoms consistent with a MI and ECG changes suggestive of a STEMI, may be given nitroglycerin 0.3 mg to 0.4 mg sublingually during the initial evaluation. Vasospastic angina may respond to sublingual nitroglycerin. The administration of sublingual nitroglycerin should not delay reperfusion therapy.
- Intravenous nitroglycerin should be considered for 24 to 48 hours in patients with a large, anterior wall MI, persistent ischemia, CHF, or hypertension.
- Nitrates should be avoided in patients with evidence for a right ventricular infarction.
- Contraindications to nitrates include the use of sildenafil within 24 hours of presentation, hypotension (systolic blood pressure <90 mm Hg), or significant bradycardia (i.e., heart rate <50 bpm).

Oral Angiotensin-Converting Enzyme Inhibitors (ACE-inhibitor)

- Oral ACE-inhibitor should be considered in all patients within 24 hours of a MI, but especially in those patients with an acute anterior wall MI, CHF from systolic dysfunction, or left ventricular ejection fraction (LVEF) <0.40.
- ACE-inhibitor should be avoided in patients with hypotension or known contraindication, including: history of ACE-inhibitor induced angioedema, hyperkalemia, acute renal failure, and bilateral renal artery stenosis.

Analgesics

- Because of increased sympathetic stimulation associated with pain from an AMI, patients should be offered analgesics, such as morphine sulfate 2 mg to 4 mg IV as needed (PRN). Per ACC/AHA AMI (1996) recommendations, analgesia should not be withheld from patients to evaluate the efficacy of reperfusion therapy.
- Routine use of anxiolytics, such as diazepam, is usually not necessary.

REPERFUSION THERAPY

Multiple studies have shown that patients who present within 12 hours of the onset of symptoms benefit the most from reperfusion strategies (i.e., percutaneous coronary intervention (PCI) or thrombolytic therapy).

While consideration for reperfusion should be given for up to 12 hours the risk:benefit ratio declines the first 6 hours. Thus, clinical judgment should be used in the decision to give reperfusion therapy, such as ongoing ischemia, size and location of the MI.

Onset of Symptoms	Intervention
<12 hours	If PCI can be accomplished within 90 minutes, refer to interventional Cardiology
<12 hours	Refer to interventional cardiology if thrombolytics are contraindicated or ineffective
<12 hours	If PCI not available/declined/inappropriate, administer thrombolytics, if not contraindicated. Transfer to CCU
>12 but <24 hours	If persistent symptoms or cardiogenic shock, refer to interventional Cardiology; consider PCI or thrombolytics
>24 hours	Continue Medical therapy

Direct PCI

Direct percutaneous revascularization, performed within 90 minutes of presentation by an experienced center and operator, is the preferred mode of reperfusion. Patients should be evaluated for thrombolytic therapy if the center evaluating the patient cannot perform direct percutaneous revascularization within 90 minutes, or the patient cannot be transferred to a facility with direct percutaneous revascularization capability and an initial presentation to balloon inflation time no greater than 90 minutes.

Patients who present with ongoing ischemic symptoms or cardiogenic shock more than 12 hours from onset of symptoms should be referred for direct percutaneous revascularization. If direct percutaneous revascularization is not available at the receiving facility, patients should be transferred to a facility with percutaneous revascularization capability.

CONTRAINDICATIONS TO THROMBOLYSIS

Patients with absolute contraindications to thrombolytic therapy should be considered for direct percutaneous revascularization. Relative contraindications are cautions only, where the relative risks and benefits must be weighted before administering the thrombolytic agent.

Absolute Contraindications to Thrombolysis

- Previous hemorrhagic stroke at any time
- Other strokes or cerebrovascular events, within one year
- Known intracranial neoplasm
- Active internal bleeding (except menses)
- Suspected aortic dissection
- Acute pericarditis

Relative Contraindications to Thrombolysis

- Severe, uncontrolled hypertension on presentation (i.e., blood pressure $>180/110$ mm Hg)
- Current use of anticoagulants in therapeutic doses
- Known bleeding problems
- Recent trauma (i.e., within 2 to 4 weeks) including head trauma or traumatic or prolonged (i.e., >10 minutes) cardiopulmonary resuscitation (CPR)
- Recent major surgery (i.e., within 3 weeks)
- Non-compressible vascular punctures
- Recent internal bleeding (i.e., within 2 to 4 weeks)
- Prior exposure to streptokinase, if that agent is to be administered (i.e., 5 days to 2 years)
- Pregnancy
- Active peptic ulcer
- History of chronic, severe hypertension
- Age >75 years
- Stroke Risk Score ≥ 4 risk factors:
 - Age ≥ 75 years
 - Female
 - African American descent
 - Prior stroke
 - Admission systolic blood pressure ≥ 160 mm Hg
 - Use of alteplase
 - Excessive anticoagulation (i.e., INR ≥ 4 ; APTT ≥ 24)
 - Below median weight (≤ 65 kg for women; ≤ 80 kg for men)

- Cardiogenic shock (i.e., sustained systolic blood pressure <90 mmHg and evidence for end-organ hypoperfusion, such as cool extremities and urine output <30 cc/hr) and CHF

THROMBOLYTIC THERAPY

Current Thrombolytic Agents

- Alteplase (tPA) (100 mg maximum): 15 mg IV bolus, then 0.75 mg/kg over 30 minutes, then 0.5 mg/kg over the next 60 minutes.
- Reteplase (rPA): 10 U over 2 minutes, followed by a second 10 U IV bolus 30 minutes later.
- Streptokinase: 1.5 million units (MU) IV over 60 minutes.
- Tenectapase: IV bolus weight adjusted (30 mg to patients who weigh <60 kg, 35 mg to patients who weigh 60 kg to 69.9 kg, 40 mg to patients who weigh 70 kg to 79.9 kg, 45 mg to patients who weigh 80 kg to 89.9 kg, and 50 mg to patients who weigh ≥ 90 kg).

Thrombolytic agents should be started in the emergency room as mortality is directly related to time to reperfusion. Once thrombolytic agents are initiated, patients may be transferred to an intensive care unit/cardiac care unit (ICC/CCU).

Clinical Signs of Reperfusion Following Thrombolytic Administration

- Resolution of chest discomfort, within 90 minutes
- At least 50% resolution of ECG changes, within 90 minutes
- Early CK washout
- Reperfusion arrhythmias (i.e., bradyarrhythmias or accelerated idioventricular rhythm)

If a patient's symptoms and/or ECG changes do not resolve within 90 minutes, the patient should be referred to cardiology and considered for salvage angioplasty, especially if an anterior wall MI exists.

CONTINUED MEDICAL THERAPY

Recommendations Following Successful Reperfusion

- Admit patient to CCU/ICU with continuous ECG monitoring for dysrhythmic events with nurse staffing appropriate to level of care.

- Draw serial cardiac markers (e.g., CK-MB t.i.d. and/or cardiac troponins b.i.d.) until peak is reached; CBC; lipid panel, if within 24 hours of onset of symptoms; electrolytes, including renal function; upright CXR, if not yet obtained.
- Administer supplemental O₂, especially for overt pulmonary congestion or arterial oxygen desaturation; O₂ may be discontinued in 2 to 6 hours following presentation for an uncomplicated MI; the use of O₂ needs to be reassessed every 24 hours for all patients.
- For electrolyte management, keep K⁺ greater than 4.0 mEq/L and Mg⁺⁺ greater than 2.0 mEq/L.
- Give aspirin, 160 mg to 325 mg P.O. qd, indefinitely (clopidogrel or ticlopidine should be administered to patients who are unable to take aspirin because of hypersensitivity or major GI intolerance).
- Intravenous heparin should be given to patients who receive alteplase, reteplase, or tenecteplase to maintain an APTT 50 to 75 seconds for 48 hours. Patients should be given intravenous heparin—especially those patients at high risk of systemic emboli—unless given a nonselective thrombolytic agent (e.g., streptokinase) and they are at low risk for systemic embolus. These latter patients can be considered for subcutaneous heparin (7,500 U to 12,500 U b.i.d., until ambulatory).
- Give intravenous nitroglycerin for the first 24 to 48 hours, if not hypotensive or bradycardic (i.e., heart rate <50 bpm) for patients with CHF, large anterior wall MI, hypertension, or recurrent ischemic symptoms. The use of nitroglycerin should be reassessed beyond 48 hours from presentation, unless the patient has recurrent angina or CHF.
- Continue oral beta-blockers or initiate, if not started. Beta-blockers should be started within 12 hours of presentation.
- Continue oral ACE-inhibitor or initiate, if not started. ACE-inhibitor should be started within 24 hours of presentation.
- Initiate dietary counseling and smoking cessation.

PATIENTS AT HIGH RISK FOR COMPLICATIONS OR DEATH

Patients at increased risk for complications or death following MI should be referred to cardiology for possible intervention. Findings that place patients at increased risk for complications or death following a MI, include the following:

- Recurrent angina (i.e., spontaneous or inducible)
- CHF
- Polymorphic ventricular tachycardia, ventricular fibrillation, or sustained monomorphic ventricular tachycardia more than 48 hours from presentation
- Prior MI
- Ejection fraction (EF) <0.40
- Associated severe mitral or aortic valvular disease (e.g., aortic stenosis, aortic regurgitation, or mitral regurgitation)

LIFE-THREATENING ARRHYTHMIAS

Bradyarrhythmias That May Require Treatment with Atropine

- Symptomatic sinus bradycardia
- Ventricular asystole
- Symptomatic, suprahisian atrioventricular (AV) block (i.e., second-degree or third-degree AV block, with a narrow-QRS-complex escape rhythm)

Bradyarrhythmias That May Require Treatment with Temporary Transvenous Pacing

- Symptomatic bradycardia that is unresponsive to medical therapy
- Asystole
- Bilateral BBB (i.e., alternating BBB or right bundle branch block (RBBB) with alternating left anterior fascicular block/left posterior fascicular block (LAFB/LPFB))
- Newly acquired trifascicular block (i.e., RBBB with LAFB/LPFB or LBBB and first-degree AV block)
- Mobitz Type-II second-degree AV block
- Complete heart block with a wide ventricular escape

Supraventricular Tachycardias That May Require Treatment

- Atrial fibrillation (AF) with rapid ventricular response should be rate-controlled with nodal blocking agents, such as a beta-blocker.
- Unstable AF (i.e., angina, hypotension, or CHF) should be considered for cardioversion.
- Paroxysmal supraventricular tachycardias (PSVT) may be cardioverted, if unstable, or treated medically with nodal blocking agents, such as a beta-blocker.

Ventricular Tachycardias That Require Treatment

- Pulseless, monomorphic ventricular tachycardia, polymorphic ventricular tachycardias, and ventricular fibrillation, all of which require defibrillation and treatment according to ACLS guidelines.
- Unstable (i.e., angina, hypotension, or CHF) monomorphic ventricular tachycardia requires synchronized cardioversion
- Stable, sustained monomorphic ventricular tachycardia may be treated initially with antiarrhythmics (i.e., lidocaine or intravenous amiodarone), followed by synchronized cardioversion, if medical therapy is unsuccessful

Ventricular Events That Do Not Require Treatment

- Accelerated idioventricular rhythm (AIVR)
- Asymptomatic premature ventricular contractions (PVCs) or asymptomatic nonsustained ventricular tachycardia (NSVT)

Antiarrhythmic agents, started at any point, may be continued 24 to 48 hours after initiation, then reassessed and stopped as soon as possible. Episodes of polymorphic ventricular tachycardia, ventricular fibrillation, or monomorphic ventricular tachycardia sustained for more than 30 seconds, more than 48 hours after presentation, should be referred to a cardiologist or electrophysiologist for further evaluation. ACLS protocols should be observed during episodes of sustained polymorphic or monomorphic ventricular tachycardia or ventricular fibrillation, until the restoration of a stable rhythm.

NON-INVASIVE EVALUATION

Obtain an Echocardiogram, if Available, to Assess for the Following:

- Reduced LV function
- Associated wall motion abnormalities
- Associated valvular disease
- Ventricular thrombus

Non-Invasive Evaluation For Myocardial Ischemia

- Patients with an uncomplicated MI should be referred for a non-invasive evaluation for ischemia at 4 to 6 days from presentation.
- Patients undergoing early coronary catheterization, or are planned for catheterization may not need a stress test.
- The yield of performing the test should be evaluated

for patients with major comorbidity that severely shorten their life expectancy.

- Patients should undergo a symptom-limited treadmill at 3 to 6 weeks for functional capacity and prognosis, if early stress was submaximal.
- Patients with evidence of ischemia during non-invasive evaluation should be considered for further cardiac evaluation, such as cardiac catheterization.
 - Hypotensive response (i.e., sustained decrease in systolic blood pressure >10 mmHg or a flat systolic blood pressure response <130 mmHg) and/or chest pain and/or ST-segment depression of ≥ 1 mm during a submaximal (low level) EST
 - Reversible perfusion defect on sestamibi or thallium myocardial imaging
 - Inducible wall motion abnormality during stress echocardiogram

DISCHARGE PATIENT TO HOME

Patients can begin regular walking programs immediately following discharge. Sexual activity may be resumed within 7 to 10 days of discharge. Patients may resume driving a week from discharge, following an uncomplicated MI, if permitted by state laws.

Patients with uncomplicated MI may be discharged to home 3 to 7 days following the acute presentation. Discharge medications should include the following, unless contraindicated:

- Aspirin
- Beta-blocker
- ACE-inhibitor
- Sublingual nitroglycerin
- Lipid-lowering therapy
- Consider Warfarin, in patients with larger, anterior wall MI

Discharge planning should include the following:

- Activity prescription
- Dietary habits
- Medical therapy
- Smoking cessation
- 4 to 6 weeks symptom-limited EST

Management of the patient's follow-up is described in Summary for Medical Follow-Up and Secondary Prevention.